

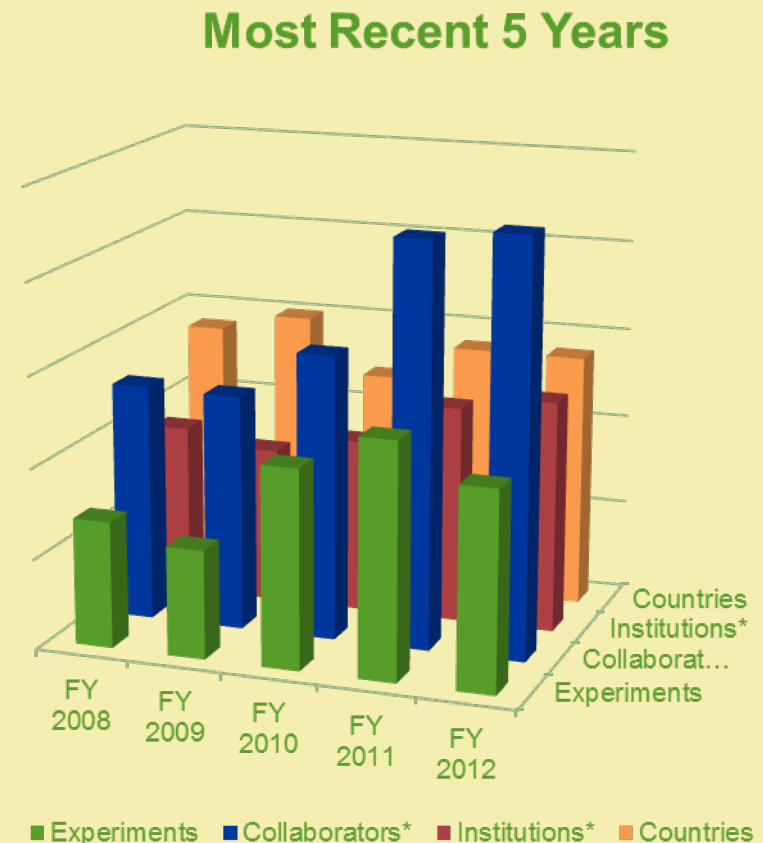
FERMILAB TEST BEAM FACILITY

Aria Soha

June 12, 2012

The Fermilab Test Beam Facility

- World Class Facility
- The only U.S. HEP Test Beam
- Detector R&D focus
- In 2012:
 - 11 experiments
 - 229 collaborators
 - 64 institutions
 - 14 countries



*Number of *Collaborators* has been scaled to fit on plot

*Number of *Institutions* has been scaled to fit on plot.

◆ FY12 only consisted of 7 months of Beam

Location

Fermi National Accelerator Laboratory



Meson Detector Building – West



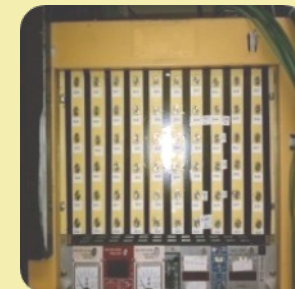
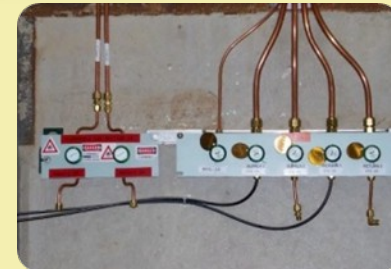
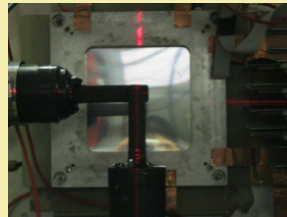
Facility Details

- Multiple Control Rooms
- Conference Room
- Climate-controlled areas for experiments
- Machine Shop
- Several Work Rooms
- Storage Rooms and Cabinets



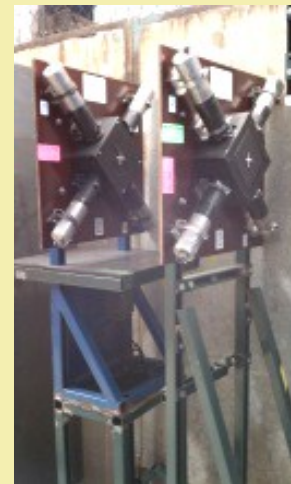
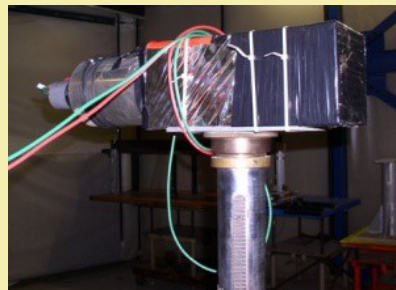
Facility Details

- Remotely controlled Motion Tables
- Laser Alignment
- State-of-the-Art, web-based Cameras
- Helium Tubes
- Gas Delivery
- Signal and High Voltage cable patch panels

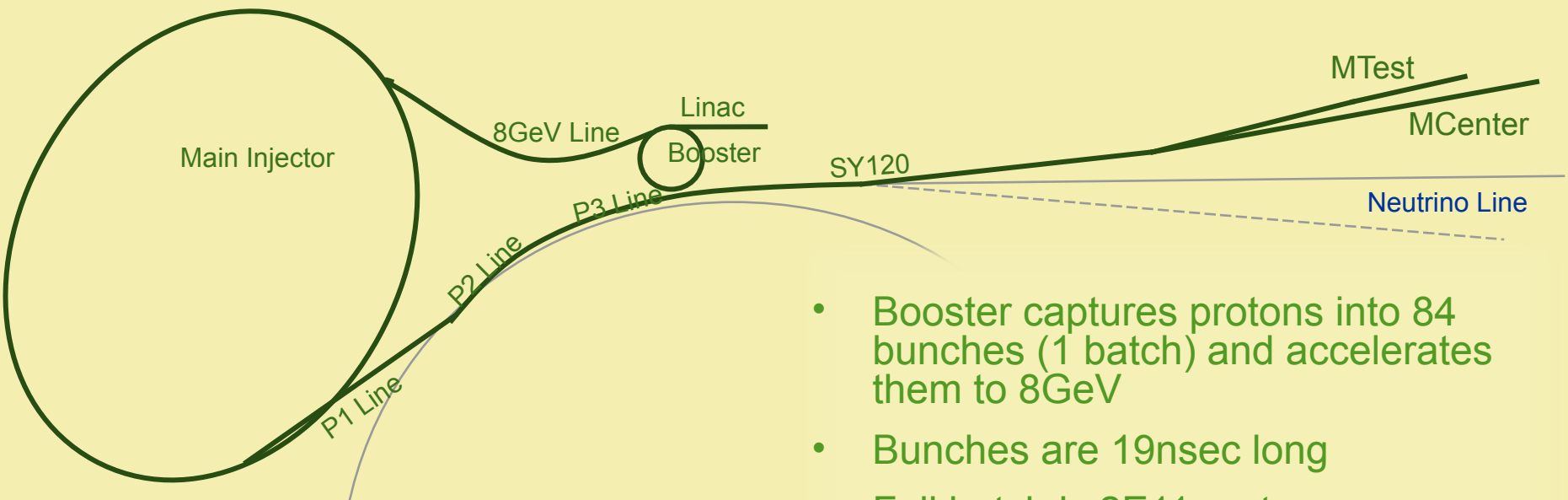


Facility Instrumentation

- 2 Cerenkov Detectors
- 2 Pixel Telescopes
- 4 MWPC Tracking System
- Time of Flight System
- Lead Glass Calorimeters
- Assorted Trigger scintillators



Beam Delivery

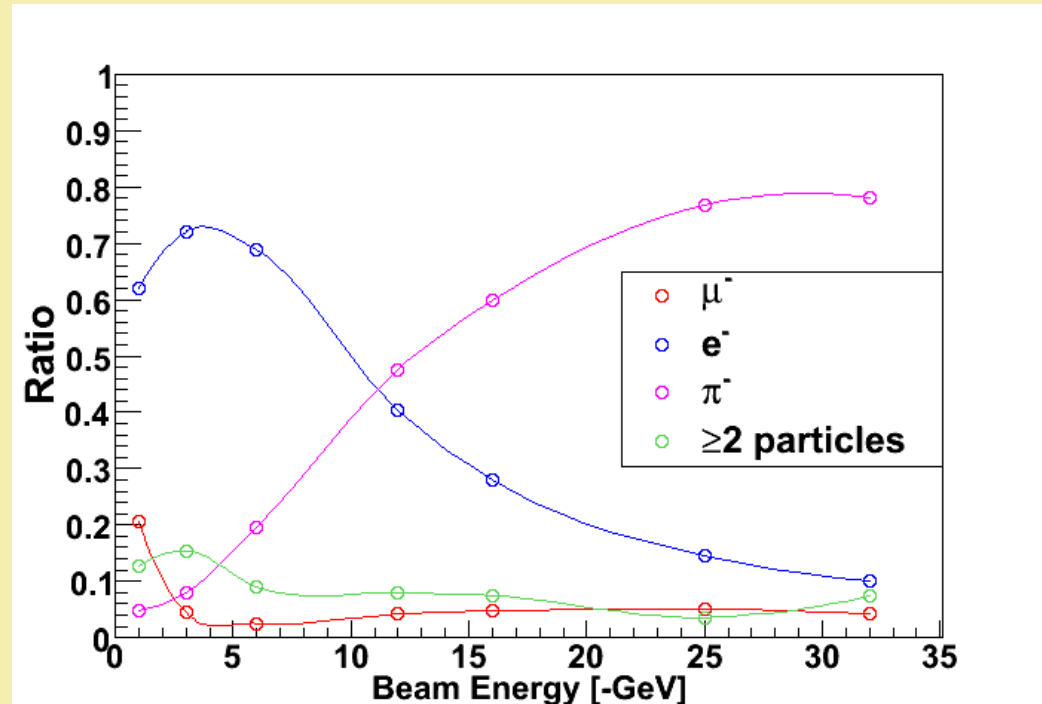


- 6 sec event
(4.2 sec spill)
every 60 seconds
- Control room manned
during beam hours

- Booster captures protons into 84 bunches (1 batch) and accelerates them to 8GeV
- Bunches are 19nsec long
- Full batch is $2E11$ protons
- Each batch is 0.2 – 1.6 μ sec in length
- MI accelerates beam to 120 GeV
- Fraction of the beam resonantly extracted each rotation over 4.2 sec to Switchyard
- In Switchyard Septa Magnet splits beam to Mesonline (and Neutrinoline)

Particle Composition of Beam

- 120 GeV Protons
- 2 - 66 GeV Pions
- 0.5 – 32 GeV Electrons
- Broadband Muons

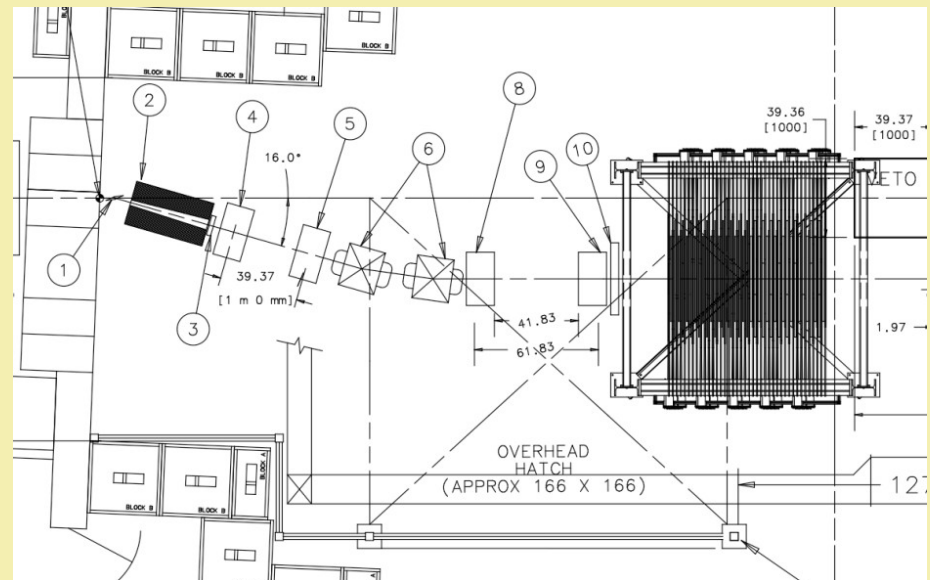


- If beam were smoothly extracted, 100 kHz or less would imply 1 particle per MI rotation would occur.
- Beam extraction is not smooth resulting in up to 35% double occupancy per MI rotation

Beam Energy (GeV)	Rate at Entrance to Facility (per spill)	Rate at Exit of Facility (per spill)	% Pions, Muons	% Electrons
16	132,000	95,000	87%	13%
8	89,000	65,000	55%	45%
4	56,000	31,000	31%	67%
2	68,000	28,000	<30%	>70%
1	69,000	21,000	<30%	>70%

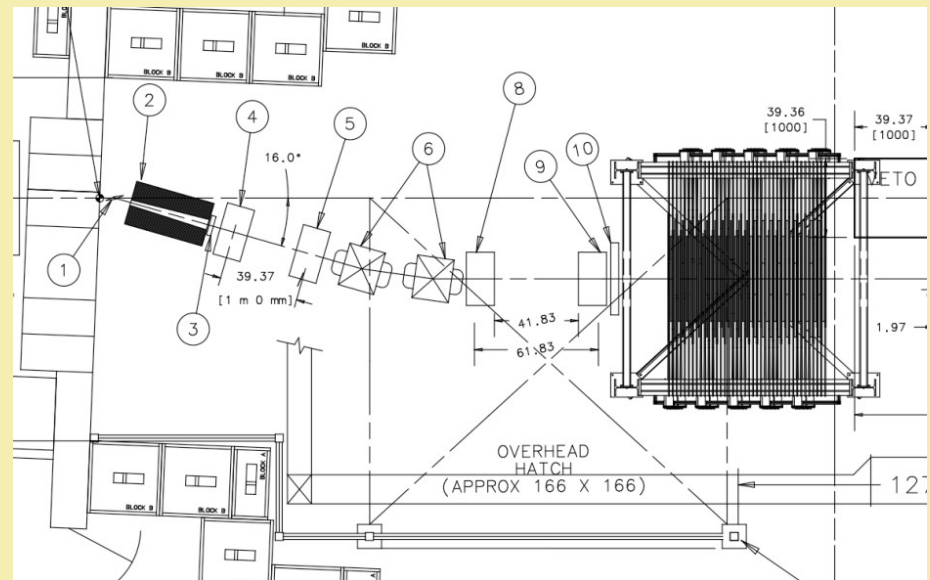
Accommodating Users

- In 2008, T-977 MINERvA experiment requested
 - ~200 – 1000 pions/spill,
 - with momentum as low as 200 MeV/c
- They requested Fermilab build another beamline...



Accommodating Users

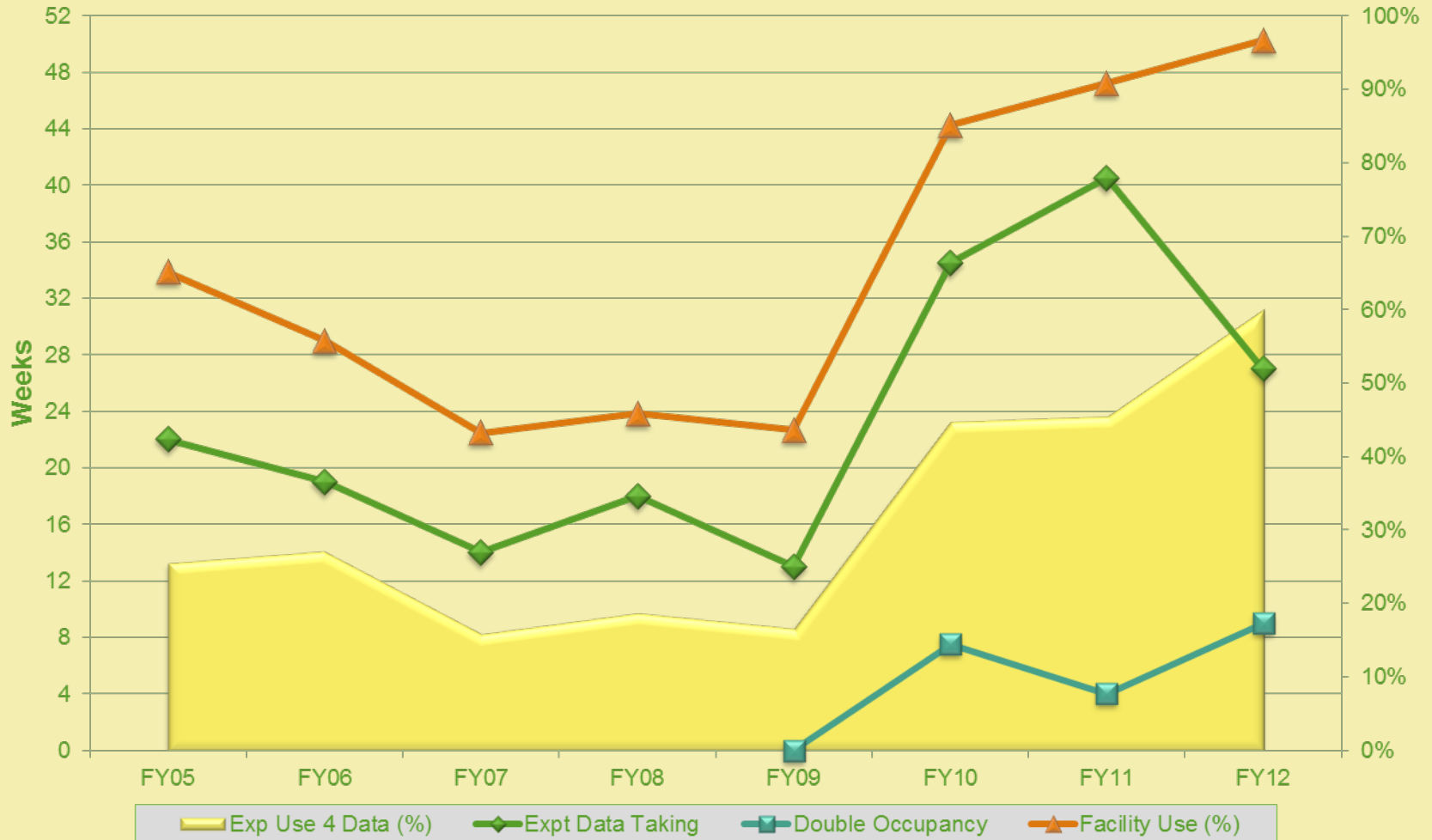
- In 2008, T-977 MINERvA experiment requested
 - ~200 – 1000 pions/spill,
 - with momentum as low as 200 MeV/c
- They requested Fermilab build another beamline...



Tertiary Beam Details

- **Rates:** ~200 particles / 4 sec spill (~50 Hz)
- 60% pions, 40% protons,
- very few electrons, kaons, and deuterons
- **Momentum Resolution:** $\Delta p = 3\%$
 - multiple scattering limited for this momentum range
- design momentum is 200MeV minimum

Weekly Usage



- FY2012 only consisted of 7 months of beam
- Facility use includes Beam studies, and educational support such as EDIT 2012.

Accelerator Shutdown

- 11 month Accelerator shutdown
- Requests for beam will be considered in January 2013 at the earliest
(even though already coming in)
- Upgrading facility during shutdown to increase User ease
 - New tracking system & read out
 - Upgraded pixel telescope
 - Expanded/Upgraded patch panel system
 - Increase facility cooling capacity for SiPM's

Facility Expansion

- Expecting MCenter addition
 - support large & long potential experiments such as
 - NOvA Calibration
 - Liquid Argon Detector Beam Test
 - MINERvA upgrade calibration test
 - Dedicated lower energy beamline
(200 MeV – 32 GeV Pions)

FTBF Summary

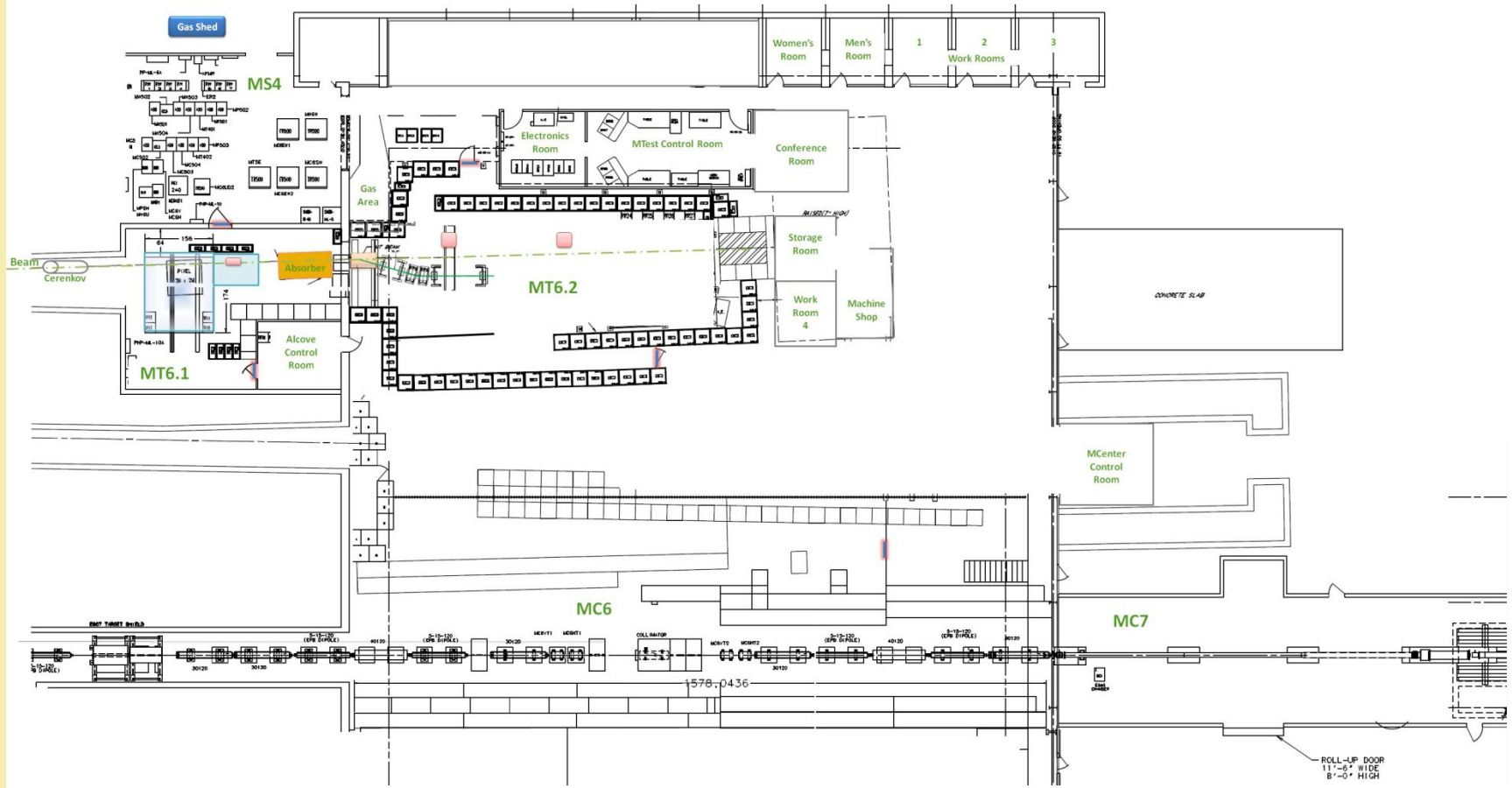
- Fermilab Test Beam Facility is an HEP Beam facility for world-wide Detector R&D
- Extensive facility infrastructure & instrumentation
- Flexible beam delivery
 - Protons, pions, muons, electrons, kaons
 - 200 MeV – 120 GeV
 - 1 – 300 kHz intensities

<http://www-ppd.fnal.gov/FTBF>

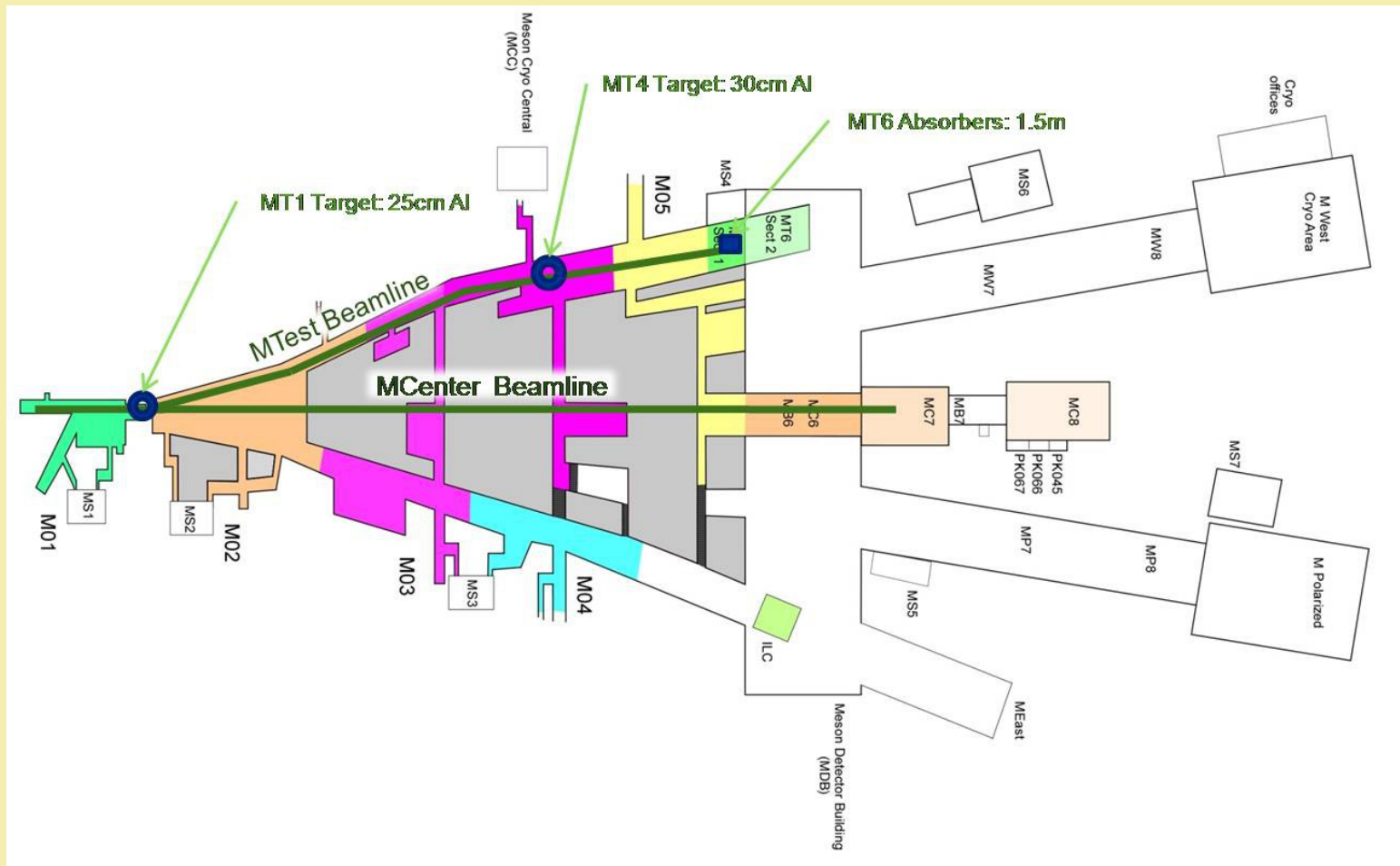
Additional Slides

ADDITIONAL SLIDES

Facility Overview



Meson Area Beamlines



MCenter User Area



This section of beam pipe has been modified to have flanges and a bellows, so as to make it easily removable.

Tertiary Beam Details

Plot of Fit Momentum vs. TOF;
Shows: Separation of Species and Available Momenta

- 60% pions,
- 40% protons,
- very few electrons, kaons, and deuterons.

